(a)

1. In terms of learning mechanism, ALS fixes one matrix (user or item) and solves for the other matrix using a least squares solution for each iteration. It iterates between the two until convergence. Neural networks adjust all model parameters simultaneously in the direction of the gradient of the loss function.

2. In terms of training procedure, ALS iterates through the dataset a fixed number of times. It solves for the latent factors based on the observed data. Neural networks require iterative gradient-based optimization methods, which require more resources and time to converge.

3. In terms of model complexity, ALS assumes a linear relationship between latent features and the observed data. Neural networks are more flexible and can learn non-linear mappings between inputs and outputs.

(b) Completed in py file.

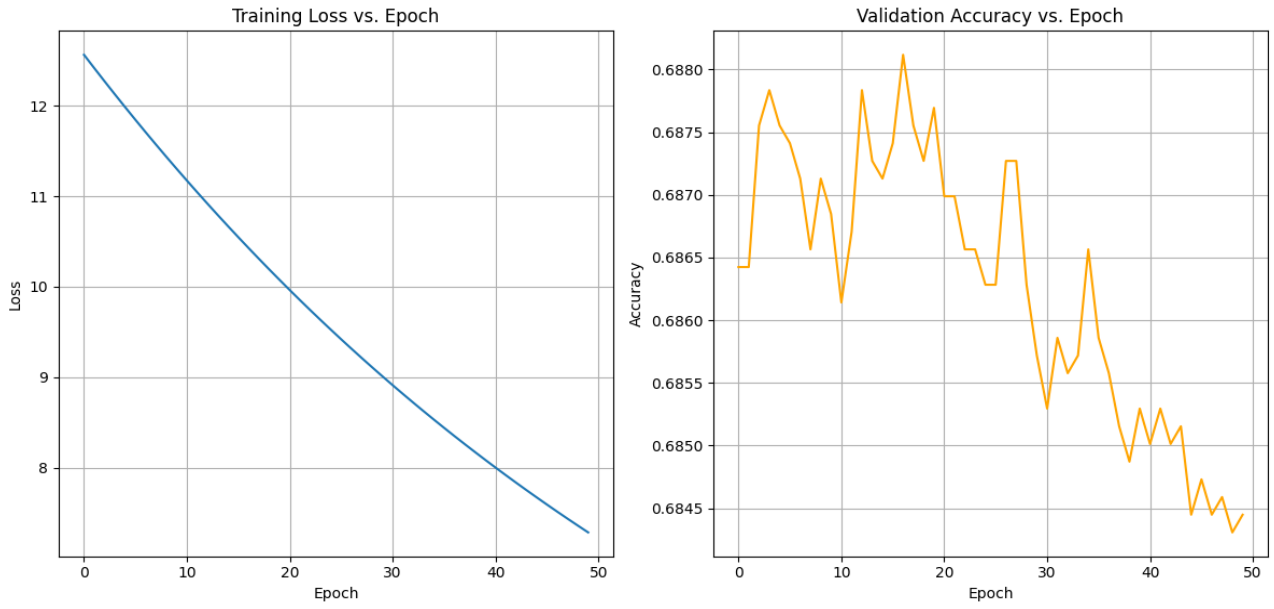
(c)

Best hyperparameters after tuning: Learning Rate = 0.01, Epoch = 50

(d)

Best k is k=50, final val accuracy: 0.6865650578605701

Test accuracy: 0.6742873271239063



(e)

Best lambda is 0.001, Val accuracy: 0.6922099915325995

Final Test accuracy with best k=50 and best lambda=0.001: 0.6821902342647473

Yes, the model does perform better with regularization penalty.